PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P005271-PCT	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/BR2004/000068	International filing date *(day/month/year)* 18.05.2004	Priority date *(day/month/year)* 22.05.2003

International Patent Classification (IPC) or national classification and IPC
F04B49/10, F04B49/06

Applicant
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1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the opinion
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
22.03.2005	26.07.2005

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/BR2004/000068

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1, 2, 4-10	as originally filed
3	received on 06.04.2005 with letter of 22.03.2005

Claims, Numbers

1-5, 6(part)	as originally filed
6(part), 7-18	received on 06.04.2005 with letter of 22.03.2005

Drawings, Sheets

1/5-5/5	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-18
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-18
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-18
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

V.1 The following documents are referred to in this report:

D1: EP 1 143 146 A (BOC GROUP PLC)
D2: US Patent 3,766,747 (LENNOX INDUSTRIES INC.)

V.2 Document D1, which is considered to represent the most relevant state of the art, discloses a sensor assembly measuring accelerations and vibrations of a fluid pump, said sensor assembly having the technical features as defined in the preamble of independent claim 1.

From this, the subject-matter of independent claim 1 differs essentially in that the accelerometer is associated to a bias circuit, the accelerometer configuring first and second acceleration transducers. The subject-matter of claim 1 is therefore novel (Article 33(2) PCT).

The technical problem to be solved by the distinguishing technical features is regarded as the prevention of impact problems in pumps resulting e.g. from variations in the fluid charges, feed voltages or external impacts. The subject-matter defined by claim 1 is considered as involving an inventive step (Article 33(3) PCT), since none of the documents cited in the search report is considered to lead a person skilled in the art in an obvious manner to foresee a bias circuit in combination with first and second acceleration transducers in order to solve the above mentioned technical problem.

V.3 Claims 2-8, as well as independent claim 18 (cooler), are referring back to claim 1, and as such also meet the requirements of the PCT with respect to novelty and inventive step.

V.4 Document D2 discloses a hermetic fluid pump (compressor) having a cylinder, a piston and an electric motor enclosed in a hermetic housing, wherein said housing includes hermetic electrical terminal means, as defined in the preamble of claim 9. Furthermore, the pump of D2 comprises a sensor assembly (sensor 60) associated to the valve mechanism of the cylinder block, wherein said sensor includes a feed terminal (70) being connectable electrically to the terminal means feeing the electric motor ("motor 42 is

connected ... through contacts 70a and 70b of relay coil 70").

The subject-matter of claim 9 differs from the pump of D2 by the presence of a signal terminal being connectable to an external measuring circuit and by a bias circuit associated to an accelerometer. The subject-matter of claim 9 is therefore novel (Article 33(2) PCT).

The technical problem to be solved by the distinguishing technical features is considered to be the same as indicated in above section V.2. The mere feature of a sensor/signal circuit being combined to an external measuring device or circuit may as such be considered to come within the scope of normal practice of a skilled person. However, the combination of distinguishing features (external measuring circuit and bias circuit) does not seem to be rendered obvious any one of the documents as cited in the search report. The subject-matter defined by claim 9 is thus considered as involving an inventive step (Article 33(3) PCT).

V.5 Claims 10 to 17 are referring back to claim 1, and as such also meet the require-ments of the PCT with respect to novelty and inventive step.

cooling compressors.

Brief Description of the Invention

The objectives of the present invention are achieved by means of a sensor assembly, to measure the movements of a fluid pump, the fluid pump being actuated by an electric motor and the electric motor being connectable to a feed voltage, the sensor comprising an accelerometer that is electrically associated to a bias circuit, the accelerometer configuring first and second acceleration transducers, and comprising a feed terminal and a signal terminal, the feed terminal being electrically connectable to the motor feed voltage, and the signal terminal being electrically connectable to an external measuring circuit.

The objectives are also achieved by means of a fluid pump comprising a cylinder, a piston, a housing comprising a fluid-tight terminal hermetically enclosing the cylinder and the piston, thus forming a hermetic assembly, the piston being actuated by an electric motor, the electric motor being linked to an electric voltage by means of a pair of voltage terminals associated to the hermetic terminal, the fluid pump comprising a sensor assembly associated to the cylinder, the sensor assembly comprising a feed terminal and a signal terminal, the feed terminal being connectable to one of the voltage terminals and the signal terminal being electrically connectable to an external measuring circuit, the sensor assembly comprising a bias circuit associated to the accelerometer, the bias circuit being mounted in an internal portion of the housing.

The objectives of the present invention are further achieved by means of a cooler having a sensor assembly that measures movements of the fluid pump, the fluid pump being actuated by an electric motor and the electric motor being connectable to a feed voltage, the sensor assembly comprising an accelerometer and wherein the accelerometer is electrically associated to a bias circuit, wherein the latter comprises a feed terminal and a signal terminal, the feed terminal being electrically connectable to the feed voltage of the motor, and the signal terminal being electrically connectable to the external measuring circuit.

Brief Description of the Drawings

The present invention will now be described in greater detail with

connected to the measuring circuit (55).

7. A sensor assembly according to claim 6, characterized in that the bias circuit (51) comprises a transistor (51a) operatively associated to the signal terminal (33) and to the feed terminal (34).

8. A sensor assembly according to claim 7, characterized in that the external measuring circuit (55) comprises a microprocessor (52), the microprocessor (52) measuring the signal of the sensor assembly (1) by means of the signal terminal (33).

9. A fluid pump (10) comprising:

- a cylinder (58),
- a piston (57), and
- a housing (50) comprising a hermetic terminal (60) and hermetically enclosing the cylinder (58) and the piston (57), forming a hermetic assembly (100),

the piston (57) being driven by an electric motor (30), the electric motor (30) being connected to an electric voltage (V) by means of a pair of voltage terminals (61, 62) associated to the hermetic terminal (60),

the fluid pump (10) being characterized by comprising a sensor assembly (1) associated to the cylinder (58), the sensor assembly (1) comprising a feed terminal (34) and a signal terminal (33), the feed terminal (34) being connected to one of the voltage terminals (61, 62) and the signal terminal (33) being electrically connectable to an external measuring circuit (55),

the sensor assembly (1) comprising a bias circuit (51) associated to the accelerometer (2), the bias circuit (51) being mounted in an internal portion (50') of the housing (50).

10. A fluid pump according to claim 9, characterized in that the sensor assembly (1) comprises an accelerometer (2) associated to a support means (3), the support means (3) being fixed to the hermetic assembly (100).

11. A fluid pump according to claim 10, characterized in that the sensor assembly (1) comprises a base portion (3a), the base portion (3a) being fixedly associable to the hermetic assembly (100).

12. A fluid pump according to claim 11, characterized in that the sensor assembly (1) comprises a weight (2a), connected to a fist insulating element (20') and to a second insulating element (20"), first and second acceleration transducers (4a, 4b), a feed terminal (34) and a signal terminal (33) projecting from the first and second acceleration transducers (4a, 4b).

13. A fluid pump according to claim 12, characterized ion that the first insulating element (20') is positioned on the surface (3a) of the support of the sensor assembly (1).

14. A fluid pump according to claim 13, characterized in that the first and second acceleration transducers (4a, 4b), the second insulating element (20") and the weight (2a) are positioned overlapping the first insulating element (20').

15. A fluid pump according to claim 14, characterized in that the bias circuit (51) comprises a transistor (51a) operatively associated to the signal terminal (33) and to the feed terminal (34).

16. A fluid pump according to claim 15, characterized in that the external measuring circuit (55) comprises a microprocessor (52), the microprocessor (52) measuring the signal of the sensor assembly (1) by means of the signal terminal (33).

17. A fluid pump according to claim 16, characterized in that the housing (50) comprises a hermetic terminal (60) for passage of the feed terminal (34) and signal terminal (33).

18. A cooler characterized by comprising a sensor assembly (1), as defined in claims 1 to 9.